

Course 26. Numerical Analysis and Computer Programming (Web Course)

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Detailed Syllabus :

NUMERICAL ANALYSIS & COMPUTER PROGRAMMING (C, C++)

I. Numerical Analysis

Approximations and round off errors, Truncation errors and Taylor Series, Determination of roots of polynomials and transcendental equations by Newton-Raphson, Secant and Bairstow's method. Solutions of linear simultaneous linear algebraic equations by Gauss Elimination and Gauss- Siedel iteration methods.

Curve fitting- linear and nonlinear regression analysis.

Backward, Forward and Central difference relations and their uses in Numerical differentiation and integration, Application of difference relations in the solution of partial differential equations.

Numerical solution of ordinary differential equations by Euler, Modified Euler, Runge-Kutta and Predictor-Corrector method.

II. Computer Programming

Introduction to computer programming in C and C++ languages. Arithmetic expressions, Simple programs. The emphasis should be more on programming techniques rather than the language itself. The C programming language is being chosen mainly because of the availability of the compilers, books and other reference materials.

Example of some simple C program. Dissection of the program line by line.

Concepts of variables, program statements and function calls from the library (printf for example)

C data types, int, char, float etc.

C expressions, arithmetic operations, relational and logic operations.

C assignment statements, extension of assignment to the operations. C primitive input output using getchar and putchar, exposure to the scanf and printf functions.

C statements, conditional execution using if, else. Optionally switch and break statements may be mentioned.

Concepts of loops, example of loops in C using for, while and do-while.

Optionally continue may be mentioned.

One dimensional arrays and example of iterative programs using arrays, 2-d arrays. Use in matrix computations.

Concept of Sub-programming, functions. Example of functions. Argument passing mainly for the simple variables.

Pointers, relationship between arrays and pointers. Argument passing using pointers.

Array of pointers, Passing arrays as arguments.

Strings and C string library.

Structure and unions. Defining C structures, passing structures as arguments.

Program examples.

File I/O. Use of fopen, fscanf and fprintf routines.

Lab

Development of computer program for

- Numerical integration by Trapezoidal and Simpson's rule.
- Gauss-Siedel iteration method
- Various matrix operation-and their use as sub-routines

Suggested Text Books & References.

- Shastry, S.S., "Numerical Methods", Prentice Hall Inc., India, 1998.
- Noble Ben, "Numerical Methods", New York International Publications, New York, 1964.
- Stanton Ralph G., "Numerical Methods for Engineering", Englewood cliffs, N.J., Prentice Hall Inc., 1961.
- Buckingham R.A., "Numerical Methods", Sir Isaac Pitman Sons. Ltd., London, 1957.
- Bakhvalov, N .S., "Numerical Methods", Mir. Pub., Moscow, 1977.
- Grewal, B.S., "Numerical Methods", Khanna Pub., New Delhi, 1998.
- Sudhit Kaicker, "The Complete ANSI C", BPB Publications, New Delhi, 1996.
- Kernighan, B. W. and D .M. Ritchie, "The C Programming Language", Prentice Hall of India, 1998.
- Byron, S. Gottfreid, "Programming with C", Tata McGraw Hill, 2nd edition 1998.